A

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date September 29, 2000 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL261869348US addressed to the: Commissioner for Patents, Washington, D.C. 20231.

Pamela Johnson
(Print Name)

(Signature)

Commissioner for Patents
BOX PATENT APPLICATION
Washington, D.C. 20231

Hoffmann-La Roche Inc.
340 Kingsland Street
Nutley, NJ 07110
Case Docket 9486
September 29, 2000

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is the patent application of

Esswein et al.

For: OSTEOBLAST-SPECIFIC MITOGENS AND DRUGS CONTAINING SUCH COMPOUNDS

Enclosed are:

1. _____ _____ sheet(s) of drawing. [ ] formal [ ] informal
2. __X__ __2__ page(s) of Declaration and Power of Attorney
3. _____ _____ page(s) of Sequence Listing
4. _____ _____ computer disk(s) containing Sequence Listing
5. _____ Statement under 37 CFR § 1.821 or 37 C.F.R. § 1.825
6. __X__ 28 pgs. of specification, 3 pgs. of claims (no abstract)

DEPOSIT ACCOUNT
NO. 08-2525
OUR ORDER NO. 3390

7. The fee has been calculated as per Preliminary Amendment shown below:

CLAIMS				
FOR	NO. FILED	NO. EXTRA	RATE	FEE
TOTAL CLAIMS	4 - 20	0	x $18	0
INDEP. CLAIMS	4 - 3	1	1 x $78	78
MULTIPLE DEPENDENT CLAIMS PRESENTED			+ $260	0
BASIC FEE				$690
TOTAL				$768

8. __X__ Please charge my Deposit Account No. 08-2525 in the amount of $768.00. This sheet is provided in triplicate.

9. _____ A check in the amount of $___ to cover the filing fee is enclosed.

10. __X__ The Commissioner is hereby authorized to charge payment of the following fees or any additional fees associated with this communication or credit any overpayment to Deposit Account No. 08-2525. This sheet is provided in triplicate.

__X__ Any filing fees required under 37 C.F.R. § 1.16.

__X__ Any patent application processing fees under 37 C.F.R. § 1.17.

11. Priority - 35 U.S.C. § 119

FOREIGN PRIORITY

[X] Foreign Priority of European Application No. 97117124.4 filed on October 2, 1997 and PCT/EP98/06214 filed on September 20, 1998 are claimed under 35 U.S.C. § 119(a)-(d) or 35 U.S.C. § 365(a)-(b).

[ ] The certified copy(ies) has(have) been filed in prior U.S. patent application Serial No. _____ on _____.

[X] The certified copy(ies) will follow.

12. RELATION BACK UNDER 35 U.S.C. § 120

(A) [X] Amend the specification by inserting, before the first line, the following sentence: -- This is a [ ] continuation [X] divisional of copending application(s) [X] Serial No. 09/508,714 filed on April 11, 2000. --

(B) [X] A copy of the oath or declaration from the prior application noted above is enclosed.

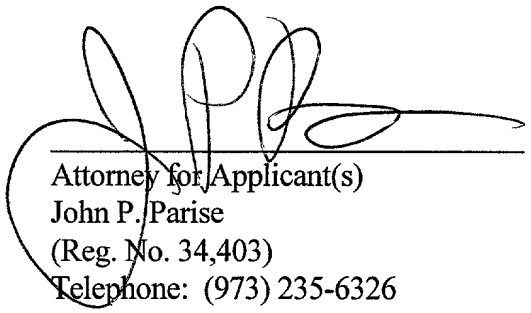
13. [X] The power of attorney in prior application is to:

George W. Johnston (Reg. No. 28,090), William H. Epstein (Reg. No. 20,008), Dennis P. Tramaloni (Reg. No. 28,542).

a. [X] The power appears in the original papers of the prior application.
b. [ ] Since the power does not appear in the original papers, a copy of the power in the prior application is enclosed.
c. [ ] Recognize as associate attorney _____.

15. Continue to address all communications to

George W. Johnston
Hoffmann-La Roche Inc.
340 Kingsland Street
Nutley, NJ 07110



Attorney for Applicant(s)
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(Reg. No. 34,403)
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Telefax: (973) 235-2363

103230

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application

Esswein et al. Group:

Division of Application No. 09/508,714, filed April 11, 2000 Examiner:

For: **OSTEOBLAST-SPECIFIC MITOGENS AND DRUGS CONTAINING SUCH COMPOUNDS**

PRELIMINARY AMENDMENT

Nutley, New Jersey 07110
September 29, 2000

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

The above-identified U.S. application is divisional application under 35 U.S.C. §1.53(b). Before calculation of the fee and examination please amend the subject application as follows:

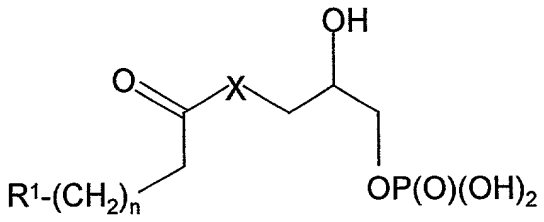
In the Claims:

Immediately preceding claim 1, change "Claims:" to -- What is claimed is: --.

Cancel claims 1-5, without prejudice.

Add new claims 6 -9 that read as follows:

-- 6. A lysophosphatidylic acid derivative selected from the group consisting of compounds of formula:



(I)

wherein

R^1 = alkenyl or alkynyl having from 6 to 24 carbon atoms;

n = 0 - 12;

X = oxygen or NH;

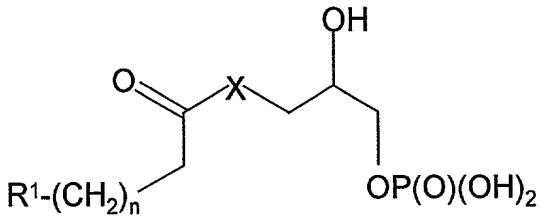
the compounds (all-cis-5,8,11, 14)-eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropyl ester; cis-9, cis-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester; (all-cis-9,12,15)-octadecatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester; cis-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester; and erucic acid 2-hydroxy-3-phosphonooxypropylester being excluded, and the physiologically tolerable salts, esters, optically active forms, and racemates of said compounds, and derivatives of said compounds, salts, esters, optically active forms and racemates, which can be metabolized *in vivo* to yield the corresponding compound of formula (I). --

-- 7. The compound *cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester. --

-- 8. The compound *cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropylamiode. --

-- 9. A drug that comprises:

a) a lysophosphatidylic acid derivative selected from the group consisting of compounds of formula:



(I)

wherein

R^1 = alkenyl or alkynyl having from 6 to 24 carbon atoms;

n = 0 - 12;

X = oxygen or NH;

the compounds (all-cis-5,8,11, 14)-eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropyl ester; cis-9, cis-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester; (all-cis-9,12,15)-octadecatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester; cis-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester; and erucic acid 2-hydroxy-3-phosphonooxypropylester being excluded, and the physiologically tolerable salts, esters, optically active forms, and racemates of said compounds, and derivatives of said compounds, salts, esters, optically active forms and racemates, which can be metabolized *in vivo* to yield the corresponding compound of formula (I); and

b) a pharmaceutically acceptable carrier. --

REMARKS

By this Amendment claims 1-5 have been canceled and new claims 6-9 have been added. Claims 6-9 are pending in the subject application.

Entry of the amendments is respectfully requested.

Respectfully submitted,

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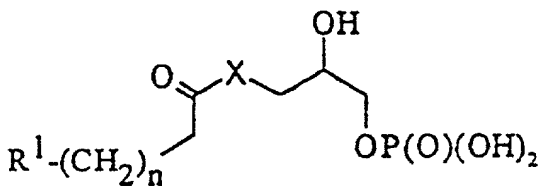
OSTEOBLAST-SPECIFIC MITOGENS AND DRUGS CONTAINING SUCH COMPOUNDS

The present invention relates to osteoblast-specific mitogenic compounds of formula (I), methods of preparing same, and drugs containing such compounds.



(I)

In healthy individuals, the formation and degradation processes in the bones are virtually at equilibrium, i.e., the activity of the osteoblasts and osteoclasts is balanced. However, if this equilibrium is disturbed in favor of the osteoclasts and/or to the disadvantage of the osteoblasts, a reduction in bone mass and a negative change in bone structure and function will be the result.

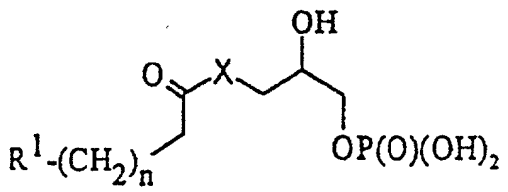
Up to now, bone resorption inhibitors such as estrogens, calcitonin and bisphosphonates are primarily used in the treatment of bone metabolic disorders. However, the use of these substances is limited and in addition, does not show the desired effect in all events. Compounds having a stimulating effect on bone formation and contributing to increase an already diminished bone mass are therefore of particular importance in the treatment of bone metabolic disorders. The European patent applications EP-A-625,522 and EP-A-524,023 describe substances having an osteoanabolic effect for osteoporosis therapy.

Lysophosphatidylic acid (LPA) is known to play a role as intracellular lipid messenger in various tissues and cell types (J. Biol. Chem. 270 (22), 12949-52, 1995; Curr. Opin. Cell. Biol. 7 (2), 203-10, 1995).

Surprisingly, it has now been found that the lysophosphatidylic acid derivatives of the present invention have a stimulating effect on bone formation and thus, are suitable for the general treatment of bone metabolic disorders. In particular, they can be used quite well in those cases where bone formation is disturbed, i.e., they are particularly suited for the treatment of osteopenic diseases of the skeletal system, such as osteoporosis, e.g., osteogenesis imperfecta, as well as for the local promotion of bone regeneration and osteoinduction, such as in orthopedic and orthodontic indications, in fracture curing, osteosyntheses, pseudarthroses and for bone implants to become incorporated.

Moreover, due to their influence on the bone metabolism, drugs containing the lysophosphatidylic acid derivatives of the present invention as active substances constitute a basis for the local and systemic treatment of rheumatoid arthritis, osteoarthritis and degenerative arthrosis.

The present invention is directed to new lysophosphatidylic acid derivatives of general formula (I)



(I)

wherein

R^1 = alkyl, alkenyl or alkynyl having from 6 to 24 carbon atoms;

n = 0 - 12;

X = oxygen or NH;

the compounds (*all-cis*-5,8,11,14)-eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropyl ester, *cis*-9,*cis*-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester, (*all-cis*-9,12,15)-octadecatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester, or *cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester being excluded, and with the proviso that if X represents oxygen, n in the $-(CH_2)_n-CH_3$ group does not represent the numbers 7, 9, 11, 13, or 15, and to the physiologically tolerable salts, esters, optically active forms, racemates, and derivatives thereof which can be metabolized *in vivo* to yield compounds of general formula (I), and to the use of said compounds in the production of drugs.

Methods of synthesizing the above compound wherein X = oxygen, and $-(CH_2)_n-CH_3$ with n = 13, are well-known (e.g., Chem. Ber. 71, 1075 (1938), Hoppe-Seyler's Z. Physiol. Chem. 347, 94-101 (1966)). Methods of synthesizing said compound wherein X = oxygen, and $-(CH_2)_n-CH_3$ with n = 15, are well-known (e.g., Chem. Phys. Lipids 1, 317 (1966/67)). Methods of synthesizing said compound wherein X = oxygen, and $-(CH_2)_n-CH_3$ with n = 7, are well-known (e.g., Chem. Phys. Lipids 18, 316 (1977)).

The compounds (*all-cis*-5,8,11,14)-eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropyl ester, *cis*-9,*cis*-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester and (*all-cis*-9,12,15)-octadecatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester are described to have an effect on the contraction of an isolated rat colon (J. Pharm. Pharmacol. 43, 774-78 (1991). An effect on blood pressure has been described for compounds wherein X = oxygen, and $-(CH_2)_n-CH_3$ with n = 9, 11, 13, 15, as well as for *cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester, *cis*-9,*cis*-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester, and (*all-cis*-9,12,15)-octadecatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester (Arzneim. Forsch. 35, 587-92 (1985)).

Each alkyl is understood to represent a straight-chain or branched C_6-C_{18} alkyl group, such as hexyl, isohexyl, 2,2-dimethylhexyl, 5-methylhexyl, heptyl,

isoheptyl, 6-methylheptyl, octyl, isooctyl, nonyl, isononyl, decyl, isodecyl, undecyl, isoundecyl, dodecyl, isododecyl, tridecyl, isotridecyl, tetradecyl, isotetradecyl, pentadecyl, isopentadecyl, hexadecyl, heptadecyl, isoheptadecyl, or octadecyl, particularly heptyl, decyl and dodecyl.

Each alkenyl represents an optionally substituted residue having 6-20 carbon atoms and one or more unsaturations, such as Δ^1-hexenyl, Δ^1-octenyl, Δ^9-nonenyl, Δ^1-decenyl, Δ^{10}-decenyl, $\Delta^{1,4}$-decadienyl, $\Delta^{1,4,7}$-decatrienyl, $\Delta^{1,4,7,10}$-hexadecatetraenyl, Δ^1-dodecenyl, Δ^5-dodecenyl, $\Delta^{1,4}$-undecadienyl, Δ^{14}-tetradecenyl, particularly Δ^1-decenyl, $\Delta^{1,4}$-decadienyl, $\Delta^{1,4,7}$-decatrienyl, wherein the double bonds may be *cis* or *trans*, and all combinations are possible in compounds having multiple unsaturations.

Each alkynyl represents an optionally substituted residue having 6-20 carbon atoms and one or more unsaturations, such as Δ^1-decynyl, Δ^1-nonynyl, $\Delta^{1,3}$-tetradecadiynyl, $\Delta^{1,3}$-hexadecadiynyl, $\Delta^{1,3}$-octadecadiynyl, particularly Δ^1-decynyl.

Compounds wherein X represents NH are particularly preferred.

Examples of physiologically usable salts of the compound of formula (I) are salts with physiologically tolerable mineral acids such as hydrochloric acid, sulfuric acid, sulfurous acid or phosphoric acid, or with organic acids such as methanesulfonic acid, p-toluenesulfonic acid, acetic acid, trifluoroacetic acid, citric acid, fumaric acid, maleic acid, tartaric acid, succinic acid, or salicylic acid. Compounds of formula (I) having a free carboxyl group may also form salts with physiologically tolerable bases. Examples of these salts are alkali metal, alkaline earth metal, ammonium, and alkylammonium salts, such as sodium, potassium, calcium, or tetramethylammonium salts.

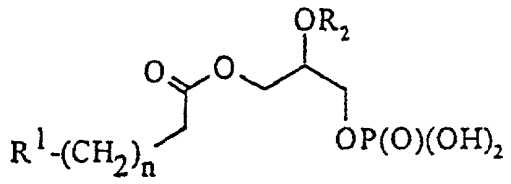
The compounds of general formula (I) contain at least one asymmetrical carbon atom and therefore, the present application is also directed to optically active

compounds of general formula (I).

The pure enantiomers of the compounds of formula (I) wherein X = oxygen are obtained by using optically active alcohols which may be purchased or prepared according to well-known methods, e.g., by traditional racemate resolution via salt formation using optically active acids.

The pure enantiomers of the compounds of formula (I) wherein X = NH are obtained by using optically active aminoalcohols which may be purchased or prepared according to well-known methods, e.g., by traditional racemate resolution via salt formation using optically active acids, or by reduction of optically active amino acids.

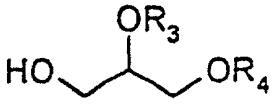
The compounds of general formula (I) wherein X = oxygen are prepared according to *per se* known methods by removing the protective group R_2 from compounds of general formula (II)



(II)

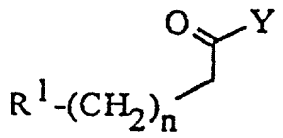
wherein R_2 represents a protective group commonly used for hydroxyl groups.

The compounds of general formula (II) are prepared according to *per se* known methods, preferably by reacting alcohols of general formula (III)



(III)

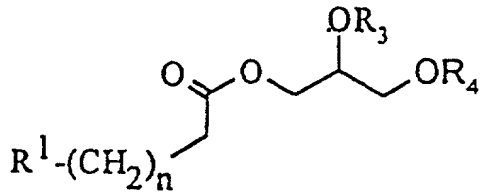
wherein R_3 and R_4 represent protective groups commonly used for hydroxyl groups, with protective groups for 1,2-diols, such as cyclic acetals and ketals being preferred, with carboxylic acid derivatives of general formula (IV)



(IV)

wherein R^1 and n have the above-mentioned meanings and Y may be a hydroxy or an activating group, and if Y represents hydroxy, activation of the carboxyl group may be effected according to the carbodiimide method, and if Y represents an activating group, mixed anhydrides, particularly with carbonic acid lower alkyl esters such as ethyl or isobutyl esters, or active esters, particularly p-nitrophenyl, 2,4,5-trichlorophenyl, N-hydroxysuccinimide, or 1-hydroxybenzotriazol esters are possible to this end,

to yield compounds of general formula (V)



(V)

The compounds of general formula (III) are prepared according to *per se* known methods, preferably by introducing protective groups into glycerol, or may be purchased.

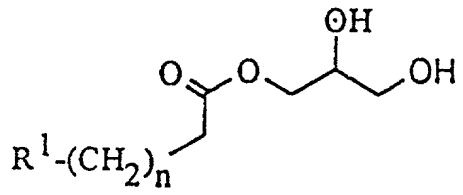
The compounds of general formula (IV) are prepared according to well-known methods starting from compounds of general formula (VI)

$$R^1\text{-}(CH_2)_{n-1}\text{-}COOH \qquad (VI)$$

wherein R^1 and n have the above-specified meanings.

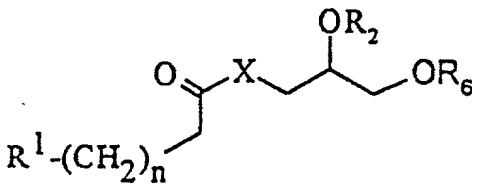
The compounds of general formula (VI) are prepared according to well-known methods of chain extension or carboxylic acid synthesis, or may be purchased.

By removing the protective groups R_3 and R_4, the compounds of general formula (V) are converted to compound (VII)



(VII)

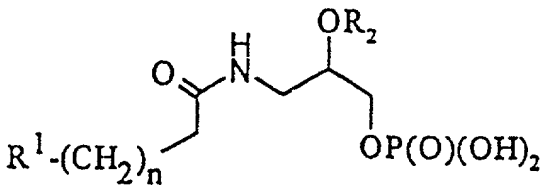
In compounds of general formula (VII), the two hydroxyl groups are protected in orthogonal fashion by introducing common hydroxyl protecting groups R_2 and R_6, preferably by introducing a trityl group (R_6) at the primary hydroxyl function and a benzoate or silyl protective group such as tert-butyldiphenylsilyl (R_2) at the secondary hydroxyl group, to yield compounds of general formula (VIII)



(VIII)

Initially, the compounds of general formula (VIII) are selectively deprotected according to *per se* known methods and then converted to compounds of general formula (II) by reacting with phosphorus oxychloride.

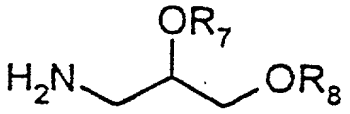
The compounds of general formula (I) wherein X = NH are prepared according to *per se* known methods by removing the R_2 protective group from compounds of general formula (IX)



(IX)

wherein R_2 represents a protective group commonly used for hydroxyl groups.

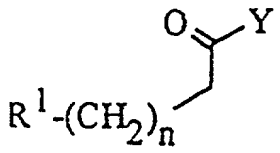
The compounds of general formula (IX) are prepared according to *per se* known methods, preferably by reacting amines of general formula (X)



(X)

wherein R_7 and R_8 may independently represent hydrogen or a protective group commonly used for hydroxyl groups, with protective groups for 1,2-diols, such as cyclic acetals and ketals being preferred,

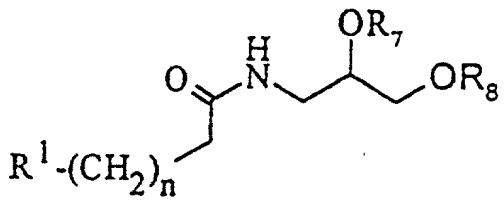
with carboxylic acid derivatives of general formula (IV)



(IV)

wherein R^1, n and Y have the above-mentioned meanings,

to yield compounds of general formula (XI)



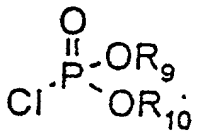
(XI)

In the event R_7 and R_8 represent hydrogen, the compounds of general formula (XI) are obtained in analogy to the method described above by using X = oxygen in the further reaction of compounds of general formula (VII).

In the event R_7 and R_8 are not orthogonal protective groups, the protective groups are removed initially according to common methods, and further proceeding is as in the case of R_7 and R_8 = hydrogen.

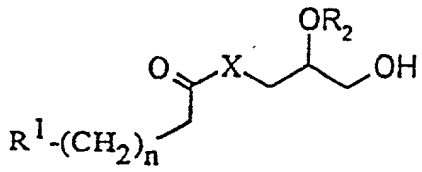
If R_7 and R_8 are orthogonal protective groups, the primary hydroxyl group is selectively deprotected first and then reacted with phosphorus oxychloride to yield compounds of general formula (IX) wherein $R_2 = R_7$.

Instead of using phosphorus oxychloride in the preparation of compounds of general formula (I), appropriately protected chlorophosphates of general formula (XII)



(XII)

wherein common protective groups, particularly methyl, ethyl or aryl are used for R_9 and R_{10}, may be reacted with compounds of general formula (XIII)



(XIII)

wherein R_2 represents a hydroxyl protecting group, preferably a benzoate or a silyl protective group. The compounds of general formula (XII) are commercially available or may be prepared according to methods well-known in literature (Houben-Weyl).

The compounds of general formula (I) are obtained by removing the protective groups R_9 and R_{10} according to well-known methods.

As protective groups R_2, R_3, R_4, R_5, R_6, R_7, R_8, R_9, and R_{10}, in principle, all those well-known protective groups suitable for hydroxyl groups are possible as are described in Th. Greene, P. Wuts, "Protective Groups in Organic Synthesis", 2nd Edn., 1991, J. Wiley & Sons. Introduction and removal are effected according to common methods described therein.

The compounds of formula (I) may be administered in liquid or solid form or as aerosols on the oral, enteral, parenteral, topical, nasal, pulmonary or rectal

routes in all the common non-toxic, pharmaceutically accepted carriers, adjuvants and additives. The compounds of formula (I) may also be applied locally on/in bones (optionally with surgical operation). The term "parenteral" includes subcutaneous, intravenous and intramuscular supply or infusions. Oral administration forms may be, e.g., tablets, capsules, coated tablets, syrups, solutions, suspensions, emulsions, elixirs, etc., which may contain one or more additives from the following groups, e.g., flavoring substances, sweeteners, colorants, and preservatives. Oral administration forms contain the active component together with non-toxic, pharmaceutically accepted carriers suitable for the production of tablets, capsules, coated tablets, etc., such as calcium carbonate, sodium carbonate, lactose, calcium phosphate or sodium phosphate; starch, mannitol, methylcellulose, talc, highly dispersed silicic acids, higher molecular weight fatty acids (such as stearic acid), peanut oil, olive oil, paraffin, Miglyol, gelatin, agar-agar, magnesium stearate, beeswax, cetyl alcohol, lecithin, glycerol, animal and vegetable fats, solid high molecular weight polymers (such as polyethylene glycols). Tablets, capsules, coated tablets, etc. may be provided with an appropriate coating such as glyceryl monostearate or glyceryl distearate, so as to prevent undesirable side effects in the stomach, or to result in prolonged activity due to delayed absorption in the gastrointestinal tract. Sterile injectable aqueous or oily solutions or suspensions are preferably used as injection media, which contain common additives such as stabilizers and solubilizers. Such additives may be, e.g., water, isotonic saline solution, 1,3-butanediol, fatty acids (such as oleic acid) mono- and diglycerides, or Miglyol. For rectal administration, all the suitable non-irritating additives may be used which are solid at normal temperatures and liquid at rectal temperature, such as cocoa butter and polyethylene glycol. For aerosol administration, the pharmaceutically common carrier media are used. For external application, creams, tinctures, gels, solutions or suspensions etc. with pharmaceutically common additives are used.

The dosage may depend on various factors such as the mode of application, species, age and/or individual condition. The doses to be administered daily or at intervals are around 1-1000 mg/person, preferably around 10-250 mg/person and may be ingested at one go or distributed over several times.

The compounds of formula (I) may be applied locally on/in bones (optionally with surgical operation). The application directly on/in bones (optionally with surgical operation) may be effected either in solution or suspension, conveniently by infusion or injection, locally or carrier-bound. For example, carrier-bound compounds of formula (I) may be applied as gels, pastes, solids or as coating on implants.

As carriers, biocompatible and preferably, biodegradable materials are used. Preferably, the materials themselves will additionally induce wound healing or osteogenesis.

For local application, it is preferred to embed the compounds of formula (I) in polymeric gels or films, thereby immobilizing them, and to apply these preparations directly on the area of the bone to be treated. These polymeric base gels or films consist of, e.g., glycerol, methylcellulose, hyaluronic acid, polyethylene oxides and/or polyoxamers. Collagen, gelatin and alginates are also suitable and are described in WO 93/00050 and WO 93/20859, for example. Other polymers are polylactic acid (PLA) and copolymers of lactic acid and glycolic acid (PLPG) (Hollinger et al., J. Biomed. Mater. Res. 17, 71-82 (1983)), and the "Demineralized Bone Matrix" (DBM) bone derivative (Guterman et al., Kollagen Rel. Res. 8, 419-4319 (1988)). Polymers such as those used for adsorbing TGFβ, for example, are also suitable and are described in EP-A 0,616,814 and EP-A 0,567,391, as well as the synthetic bone matrices according to WO 91/18558.

Materials commonly used when implanting bone substitutes or other therapeutically active substances are also suitable as carriers for the compounds of formula (I). Such carriers are also based on, e.g., calcium sulfate, tricalcium phosphate, hydroxyapatite and its biodegradable derivatives, and polyanhydrides. Apart from these biodegradable carriers, those carriers are also suitable which are not biodegradable, yet are biocompatible. For example, these carriers are sintered hydroxyapatite, bioglass, aluminates or other ceramic materials (e.g., calcium

aluminate phosphate). These materials are preferably used in combination with said biodegradable materials, such as, in particular, polylactic acid, hydroxyapatite, collagen, or tricalcium phosphate. Other non-degradable polymers have been described in the US patent 4,164,560, for example.

Particularly preferred is the use of carriers which continuously release the compounds of formula (I) at the site of action. Especially suited for this purpose are, e.g., the "slow release pellets" by Innovative Research of America, Toledo, Ohio, USA. Particularly preferred is the use of pellets releasing the compounds of formula (I) over several days, preferably up to 100 days, at a daily dose of 1-10 mg/kg per day.

The dosage may depend on various factors such as the mode of application, species, age and/or individual condition. The doses of active substance to be administered daily are around from 0.01 mg to about 100 mg/kg body weight, preferably from 0.1 to 10 mg/kg body weight and may be applied at one go or distributed over several times.

Apart from the compounds mentioned in the examples, and the compounds which may be derived by combining all the meanings of the substituents mentioned in the claims, the following lysophosphatidylic acid derivatives, as well as their sodium and potassium salts are preferred in the meaning of the present invention:

Preferred compounds (PC):

(1) Octanoic acid 2-hydroxy-3-phosphonooxypropyl ester
(2) 7-Methyloctanoic acid 2-hydroxy-3-phosphonooxypropyl ester
(3) 7,7-Dimethyloctanoic acid 2-hydroxy-3-phosphonooxypropyl ester
(4) Nonanoic acid 2-hydroxy-3-phosphonooxypropyl ester
(5) 4-Methylnonanoic acid 2-hydroxy-3-phosphonooxypropyl ester
(6) 8-Methylnonanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(7) Undecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(8) 10-Methylundecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(9) 11-Methyldodecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(10) Tridecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(11) 12-Methyltridecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(12) 13-Methyltetradecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(13) Pentadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(14) 14-Methylpentadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(15) 15-Methylhexadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(16) Heptadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(17) 16-Methylheptadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(18) 17-Methyloctadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(19) Nonadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(20) 18-Methylnonadecanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(21) Eicosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(22) 19-Methyleicosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(23) 19-Methyleicosanoic acid 2-hydroxy-3-phosphonooxy-propyl ester

(24) Heneicosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(25) Docosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(26) Tricosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(27) Tetracosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(28) Heptacosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(29) Octacosanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(30) Triacontanoic acid 2-hydroxy-3-phosphonooxypropyl ester

(31) 6-Heptenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(32) *trans*-9-Hexadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(33) (*all-cis*-11,14,17)-Eicosatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(34) *cis*-10-Heptadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(35) *cis*-10-Nonadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(36) *cis*-3,*cis*-6-Nonadienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(37) *cis*-10-Pentadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(38) *cis*-12-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(39) *cis*-13-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(40) *cis*-7-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(41) *cis*-8-Eicosenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(42) *trans*-9-Tetradecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(43) *trans*-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(44) (*all-trans*-9,11,13,15)-Octadecatetraenoic acid 2-hydroxy-3-phosphonooxypropylester

(45) (*all-cis*-9,11,13,15) Octadecatetraenoic acid 2-hydroxy-3-phosphonooxypropyl-ester

(46) *cis*-11-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(47) (*all-cis*-13,16,19)-Docosatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(48) (*all-cis*-13,16,19)-Docosatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(49) (*all-cis*-8,11,14)-Eicosatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(50) *trans*-11-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(51) *trans*-13-Docosenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(52) *trans*-9,*trans*-12-Octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(53) *cis*-9-Tetradecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(54) *cis*-9-Hexadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(55) 10-Undecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(56) *cis*-11,*cis*-14-Eicosadienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(57) *cis*-11-Eicosenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(58) *cis*-15-Tetracosenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(59) 11-Dodecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(60) 9-Decenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(61) 16-Heptadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(62) (*all-cis*-11,14,17)-Eicosatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester

(63) *cis*-13-Eicosenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(64) (*all-cis*-7,10,13,16)-Docosatetraenoic acid 2-hydroxy-3-phosphonooxypropylester

(65) 22-Tricosenoic acid 2-hydroxy-3-phosphonooxypropyl ester

(66) 9-Tetradecynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(67) 13-Eicosynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(68) 10,12-Nonacosadiynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(69) 10,12-Octadecadiynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(70) 9-Octadecynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(71) 10-Undecynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(72) 10,12-Tricosadiynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(73) 10,12-Pentacosadiynoic acid-2-hydroxy-3-phosphonooxypropyl ester

(74) 10,12-Heptacosadiynoic acid 2-hydroxy-3-phosphonooxypropyl ester

(75) Octanoic acid 2-hydroxy-3-phosphonooxypropylamide

(76) 7-Methyloctanoic acid 2-hydroxy-3-phosphonooxypropylamide

(77) 7,7-Dimethyloctanoic acid 2-hydroxy-3-phosphonooxypropylamide

(78) Nonanoic acid 2-hydroxy-3-phosphonooxypropylamide

(79) 4-Methylnonanoic acid 2-hydroxy-3-phosphonooxypropylamide

(80) 8-Methylnonanoic acid 2-hydroxy-3-phosphonooxypropylamide

(81) Decanoic acid 2-hydroxy-3-phosphonooxypropylamide

(82) Undecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(83) 10-Methylundecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(84) Dodecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(85) 11-Methyldodecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(86) Tridecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(87) 12-Methyltridecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(88) Tetradecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(89) 13-Methyltetradecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(90) Pentadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(91) 14-Methylpentadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(92) Hexadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(93) 15-Methylhexadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(94) Heptadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(95) 16-Methylheptadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(96) Octadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(97) 17-Methyloctadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(98) Nonadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(99) 18-Methylnonadecanoic acid 2-hydroxy-3-phosphonooxypropylamide

(100) Eicosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(101) 19-Methyleicosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(102) 19-Methyleicosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(103) Heneicosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(104) Docosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(105) Tricosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(106) Tetracosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(107) Heptacosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(108) Octacosanoic acid 2-hydroxy-3-phosphonooxypropylamide

(109) Triacontanoic acid 2-hydroxy-3-phosphonooxypropylamide

(110) 6-Heptenoic acid 2-hydroxy-3-phosphonooxypropylamide

(111) *trans*-9-Hexadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(112) (*all-cis*-11,14,17)-Eicosatrienoic acid 2-hydroxy-3-phosphonooxypropylamide

(113) (*all-cis*-5,8,11,14)-Eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropylamide

(114) *cis*-10-Heptadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(115) *cis*-10-Nonadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(116) *cis*-3,*cis*-6-Nonadienoic acid 2-hydroxy-3-phosphonooxypropylamide

(117) *cis*-10-Pentadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(118) *cis*-12-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(119) *cis*-13-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(120) *cis*-7-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(121) *cis*-8-Eicosenoic acid 2-hydroxy-3-phosphonooxypropylamide

(122) *trans*-9-Tetradecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(123) *cis*-9,*cis*-12-Octadecadienoic acid 2-hydroxy-3-phosphonooxypropylamide

(124) *trans*-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(125) *cis*-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(126) (*all-trans*-9,11,13,15)-Octadecatetraenoic acid 2-hydroxy-3-phosphonooxypropylamid

(127) (*all-cis*-9,11,13,15)-Octadecatetraenoic acid 2-hydroxy-3-phosphonooxypropylamid

(128) *cis*-11-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(129) (*all-cis*-13,16,19)-Docosatrienoic acid 2-hydroxy-3-phosphonooxypropylamide

(130) (*all-cis*-13,16,19)-Docosatrienoic acid 2-hydroxy-3-phosphonooxypropylamide

(131) (*all-cis*-9,12,15)-Octadecatrienoic acid 2-hydroxy-3-phosphonooxypropylamide

(132) (*all-cis*-8,11,14)-Eicosatrienoic acid 2-hydroxy-3-phosphonooxypropylamide

(133) *trans*-11-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(134) *trans*-13-Docosenoic acid 2-hydroxy-3-phosphonooxypropylamide

(135) *trans*-9,*trans*-12-Octadecadienoic acid 2-hydroxy-3-phosphonooxypropylamide

(136) *cis*-9-Tetradecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(137) *cis*-9-Hexadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(138) 10-Undecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(139) *cis*-11,*cis*-14-Eicosadienoic acid 2-hydroxy-3-phosphonooxypropylamide

(140) *cis*-11-Eicosenoic acid 2-hydroxy-3-phosphonooxypropylamide

(141) *cis*-15-Tetracosenoic acid 2-hydroxy-3-phosphonooxypropylamide

(142) 11-Dodecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(143) 9-Decenoic acid 2-hydroxy-3-phosphonooxypropylamide

(144) 16-Heptadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

(145) (*all-cis*-11,14,17)-Eicosatrienoic acid 2-hydroxy-3-phosphonooxypropylamide

(146) *cis*-13-Eicosenoic acid 2-hydroxy-3-phosphonooxypropylamide

(147) *cis*-13,*cis*-13-Docosadienoic acid 2-hydroxy-3-phosphonooxypropylamide

(148) (*all-cis*-7,10,13,16)-Docosatetraenoic acid 2-hydroxy-3-phosphonooxypropylamide

(149) 22-Tricosenoic acid 2-hydroxy-3-phosphonooxypropylamide

(150) 9-Tetradecynoic acid 2-hydroxy-3-phosphonooxypropylamide

(151) 13-Eicosynoic acid 2-hydroxy-3-phosphonooxypropylamide

(152) 10,12-Nonacosadiynoic acid 2-hydroxy-3-phosphonooxypropylamide

(153) 10,12-Octadecadiynoic acid 2-hydroxy-3-phosphonooxypropylamide

(154) 9-Octadecynoic acid 2-hydroxy-3-phosphonooxypropylamide

(155) 10-Undecynoic acid 2-hydroxy-3-phosphonooxypropylamide

(156) 10,12-Tricosadiynoic acid 2-hydroxy-3-phosphonooxypropylamide

(157) 10,12-Pentacosadiynoic acid 2-hydroxy-3-phosphonooxypropylamide

(158) 10,12-Heptacosadiynoic acid 2-hydroxy-3-phosphonooxypropylamide

Some process variants which may be used to synthesize the compounds according to the invention will be given in the following examples which, however, should not be construed as to be limiting to the subject of the invention. The structures of the compounds were established using ^{1}H, ^{31}P and optionally ^{13}C-NMR spectroscopy. The purity of the substances was determined using C, H, N, P analysis and thin layer chromatography.

Example 1

***cis*-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester**

cis-9-Octadecenoic acid 2,3-O-isopropylidenepropyl ester (1)

To a solution of 15.4 g (116 mmol) of 2,2-dimethyl-4-hydroxymethyldioxolane in 100 ml of pyridine is added dropwise 41.2 g (116 mmol) of 85% oleic acid chloride at room temperature. After 12 hours at room temperature the pyridine is removed, the residue is added with 2 x 50 ml of toluene and concentrated by evaporation. The residue is taken up in 200 ml of diethyl ether and extracted twice with 50 ml of 1N HCl and 50 ml of saturated NaCl solution. The ether phase is dried with $MgSO_4$, filtrated and concentrated. The residue is purified on a silica gel flash column using heptane/ethyl acetate (9:1). Yield: 26.3 g (61%).

cis-9-Octadecenoic acid 2,3-dihydroxypropyl ester (2)

24 g (60.5 mmol) 1 is dissolved in a mixture of THF/water (6:1) and cooled to 0°C. Then, trifluoroacetic acid (24 ml) is added dropwise, and the mixture is stirred for another 3 hours at 0°C and warmed to room temperature. After 12 hours, cooling to 0°C and neutralization with concentrated ammonia is effected. The THF is distilled off, and the residue is extracted with diethyl ether. The combined organic phases are dried over $MgSO_4$, filtrated and concentrated. The residue is purified on a silica gel column using heptane/ethyl acetate (1:1). Yield: 68% of a colorless oil.

cis-9-Octadecenoic acid 2-hydroxy-3-triphenylmethoxypropyl ester (3)

A solution of 2 (21 mmol) in 80 ml of dichloromethane/pyridine (1:1) is added dropwise with triphenylmethyl chloride (27 mmol) and stirred at room temperature for 48 hours. The solvent is removed, and the residue is added twice with 50 ml of toluene and concentrated. The residue is diluted with 100 ml of H_2O and extracted three times with 50 ml of dichloromethane. The combined organic phases are washed with 50 ml of cold 5% HCl and 50 ml of saturated NaCl solution, dried over $MgSO_4$, filtrated and concentrated. The residue is purified by chromatography on silica gel using heptane/ethyl acetate (5:1). Yield: 88% of a colorless oil.

cis-9-Octadecenoic acid 2-tert-butyldiphenylsilyloxy-3-triphenylmethoxypropyl ester (4)

To a solution of 3 (5 mmol) in 30 ml of DMF is added imidazole (20 mmol) at 0°C. tert-Butyldiphenylsilyl chloride then is added dropwise to this mixture. The mixture is slowly warmed to room temperature. After 6 hours at room temperature, this is poured into ice water and extracted with ethyl acetate. The combined organic phases are washed with saturated NaCl solution, dried over $MgSO_4$, filtrated and concentrated. The residue is purified by silica gel chromatography using isohexane/ethyl acetate (9:1). Yield: 95% of a colorless oil.

cis-9-Octadecenoic acid 2-tert-butyldiphenylsilyloxy-3-hydroxypropyl ester (5)

4 ml of trifluoroacetic acid is slowly dropped into a solution of 4 (4.65 mmol) in 50 ml of dichloromethane at room temperature. After 3 hours, this is washed with water and saturated sodium hydrogen carbonate solution. The combined organic phases are dried over $MgSO_4$, filtrated and concentrated. The residue is purified on silica gel by flash chromatography using isohexane/ethyl acetate (7:1). Yield: 54% of a colorless oil.

cis-9-Octadecenoic acid 2-tert-butyldiphenylsilyloxy-3-phosphonooxypropyl ester (6)

A solution of phosphorus oxychloride (3 mmol) in 5 ml of tetrahydrofuran is cooled to 0°C under nitrogen, and a solution of 5 (2.75 mmol) and pyridine (9.3 mmol) in 15 ml of tetrahydrofuran is added dropwise. The mixture is stirred at 0°C for 30 minutes. Then, 3 ml of water is added, and stirring is effected for 20 hours at room temperature. This is subsequently acidified by dropwise addition of 1N HCl and extracted three times with 25 ml of ethyl acetate. The combined organic phases are dried over $MgSO_4$, filtrated and concentrated. The residue is subjected to chromatography on silica gel using ethyl acetate first and then methanol. Yield: 71% of a colorless oil.

cis-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester

6 (1 mmol) is dissolved in 10 ml of dichloromethane, and 25 ml of a 1% methanolic NaOH solution is added. This is concentrated after 20 hours at room temperature, and the residue is acidified with 1N HCl. The mixture is extracted with ethyl acetate. The combined organic phases are washed with 20 ml of H_2O and dried over $MgSO_4$, filtrated and concentrated. The residue is treated with methanol. Yield: 78% of colorless crystals.

Example 2

cis-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide

cis-9-Octadecenoic acid succinimide (8)

Dicyclcohexylcarbodiimide (24.1 g, 117 mmol) dissolved in THF is added to a solution of oleic acid (30 g, 106.2 mmol) in 150 ml of THF at 0°C. After 20 minutes, N-hydroxysuccinimide (13.5 g, 117 mmol) is added to the mixture. The mixture is slowly warmed to room temperature. After 18 hours at room temperature, cooling to 0°C is effected, and the precipitate is sucked off. The filtrate is concentrated and purified on a silica gel column using ethyl acetate/heptene (1:3). Yield: 83% of a colorless wax.

cis-9-Octadecenoic acid 2,3-dihydroxypropylamide (9)

To a solution of *cis*-9-octadecenoic acid succinimide (18.3 g, 48.2 mmol) in 50 ml of acetonitrile is added 1-amino-2,3-propanediol (4.4 g, 48.2 mmol) in 50 ml of H_2O. After stirring for 12 hours at room temperature the acetonitrile is distilled off and the residue is extracted with ethyl acetate. The combined organic phases are extracted with saturated NaCl solution. The organic phase is dried with $MgSO_4$, filtrated and concentrated. The residue is crystallized from isohexane. Yield: 87% of a colorless powder.

cis-9-Octadecenoic acid 2-hydroxy-3-triphenylmethoxypropylamide (10)

A solution of 9 (28 mmol) in 80 ml of dichloromethane/pyridine (1:1) is added dropwise with triphenylmethyl chloride (36 mmol) and stirred at room temperature for 48 hours. The solvent is removed, and the residue is added twice with 50 ml of toluene and concentrated. The residue is diluted with 100 ml of H_2O and extracted three times with 50 ml of dichloromethane. The combined organic phases are washed with 50 ml of cold 5% HCl and 50 ml of saturated NaCl solution, dried

over $MgSO_4$, filtrated and concentrated. The residue is purified by chromatography on silica gel using heptane/ethyl acetate (2:1). Yield: 81% of a colorless oil.

cis-9-Octadecenoic acid 2-benzoyloxy-3-triphenylmethoxypropylamide (11)

Benzoyl chloride (30 mmol) is added dropwise at 0°C to a solution of 10 (27.3 mmol) in 80 ml of dichloromethane/pyridine (1:1). Slow warming to room temperature is allowed to take place, and stirring is continued for another 4 hours at room temperature. The mixture is then concentrated, added twice with 50 ml of toluene and concentrated. The residue is added with 100 ml of H_2O and extracted three times with 100 ml of dichloromethane. The combined organic phases are washed with 50 ml of cold 5% HCl and 50 ml of saturated NaCl solution, dried over $MgSO_4$, filtrated and concentrated. The residue is purified by silica gel chromatography using heptane/ethyl acetate (3:1). Yield: 87% of a colorless oil.

cis-9-Octadecenoic acid 2-benzoyloxy-3-phosphonooxypropyl-amide (12)

A solution of phosphorus oxychloride (7.1 mmol) in 10 ml (22 mmol) THF is added dropwise to a solution of 11 in 30 ml of tetrahydrofuran under nitrogen. The mixture is stirred at 0°C for 30 minutes. Then, 5 ml of water is added, and stirring is effected for 20 hours at room temperature. The mixture is acidified by dropwise addition of 1N HCl and extracted three times with 50 ml of ethyl acetate; the combined organic phases are dried over $MgSO_4$, filtrated and concentrated. The residue is subjected to chromatography on silica gel using ethyl acetate first and then methanol. Yield: 54% of a colorless oil.

cis-9-Octadecenoic acid 2-hydroxy-3-phosphonooxypropylamide (13)

12 (1.76 mmol) is dissolved in 20 ml of dichloromethane, and 50 ml of a 1% methanolic NaOH solution is added. This is concentrated after 20 hours at room temperature, and the residue is acidified with 1N HCl. The mixture is extracted with ethyl acetate. The combined organic phases are washed with 50 ml of H_2O and dried over $MgSO_4$, filtrated and concentrated. The residue is treated with methanol. Yield: 82% of colorless crystals.

Example 3

The compounds of formula (I) were examined in primary cultures of osteoblasts from fetal rat calvaria using a DNA synthesis assay. The experiments were performed following Pfeilschifter *et al.*, Endocrinology 126, 703 (1990).

Test specification: BrdU method

The DNA synthesis performance as a surrogate parameter for proliferation was determined using the cell proliferation ELISA, BrdU (colorimetric) by Boehringer Mannheim, Mannheim, Germany.

The primary osteoblasts were recovered by sequential digestion using collagenase from fetal rat calvaria, thus obtaining 5 cell fractions. A pool of cell fractions 3-5 was cultivated *in vitro*. The cells were cultivated in an incubator at a relative humidity of 95%, a CO_2 content of 5%, and a temperature of 37°C. The test substances were examined in cultures of the first, second or third cell passage.

For testing, the cells were seeded at a cell number of 7×10^3 cells (in 100 µl of culture medium)/well into flat-bottom micro-well plates (MWP) at least 96 hours prior to applying the test substances. To this end, MEM Dulbecco (plus 4.5 g/l of glucose, plus 3.7 g/l of $NaHCO_3$, with no glutamine) added with 5% fetal calf

serum (FCS) and penicillin (100 U/ml)/streptomycin (0.1 mg/ml) was used as culture medium.

Immediately prior to adding the test substances to the cell culture, the medium was replaced by 100 µl of a medium containing 1 mg/ml bovine serum albumin (BSA) instead of FCS. The test substances were added at the desired concentrations to the BSA-containing medium. TGFβ_1 (transforming growth factor β_1) at concentrations from 0.1 to 0.2 ng/ml was included as a positive control. Three determinations were carried out for each (positive) control and substance concentration, respectively.

Incubation of the cell cultures including test substances was effected over 24 hours, a BrdU probe (addition of 10 µl of a 100 µM 5-bromo-2'-deoxyuridine solution) additionally being present during the last 3 hours.

At the end of the incubation period, the cell lawn was fixed for 30 minutes using 200 µl of FixDenat™ solution at room temperature, simultaneously denaturing the DNA. The fixed cell lawn was subsequently covered with 100 µl of anti-BrdU-POD solution and incubated for 90 minutes at room temperature. After washing three times with 200 µl of PBS solution, the MWP wells were added with 100 µl of substrate solution (TMB = tetramethylbenzidine) and incubated for 5 minutes at room temperature.

The optical density was determined using an ATTC 340 MTP Reader by the SLT Company, where the wavelength of the measuring beam was 370 nm, and that of the reference beam was 492 nm. Recording and processing of the source data was performed using the "easyWINbasic" software by SLT Company.

Cell cultures which solely had received BSA-containing medium were used as controls (100%) in the assessment.

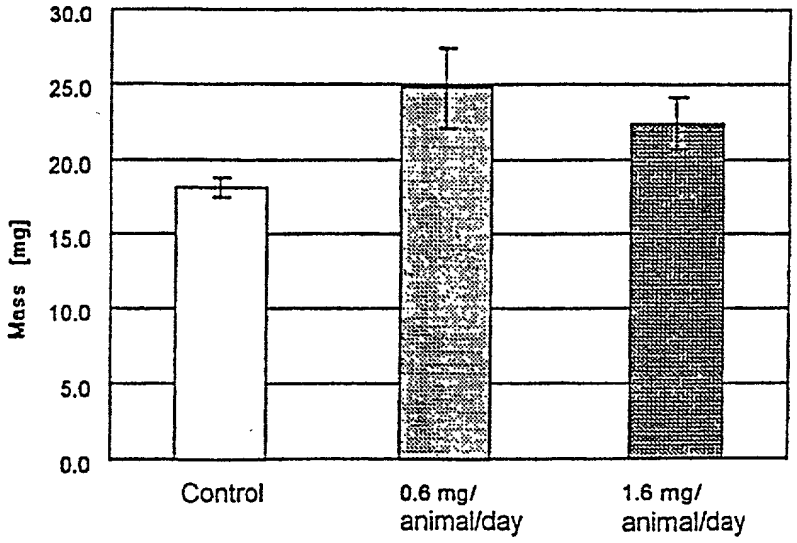
Table I: Effect of L-α-*cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester on the DNA synthesis rate of fetal rat osteoblasts

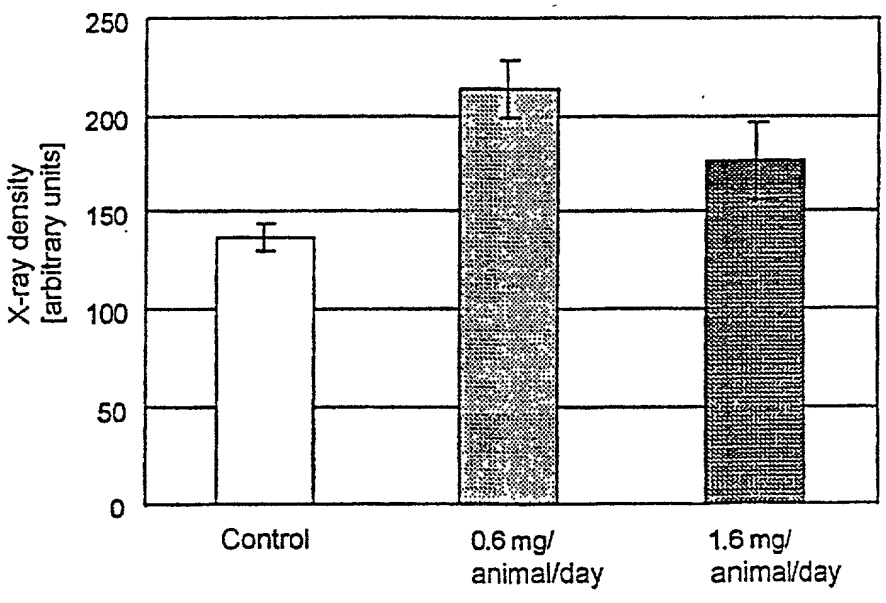
Concentration (μg/ml)	0.3	1.0	3.0	10.0
Effect in % relative to control (control = 100%)	161 ± 13	185 ± 12	253 ± 30	284 ± 22

Mean value ± standard deviation, n= 8

The compounds of formula (I) were also examined for stimulation of bone formation in an *in vivo* test model using Balb/c mice. The experiments were carried out following Mackie and Trechsel: Stimulation of bone formation in vivo by transforming growth factor-β: Remodeling of woven bone and lack of inhibition by indomethacin, Bone 11, 295-300, 1990.

Table II: Comparison of bone mass in controls and subsequent to local administration of L-α-*cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester to intact calottes of mice





Mean value ± standard deviation, n= 6

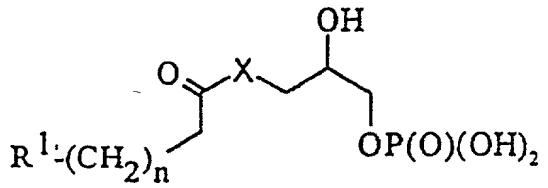
Table III: Increase of bone mass in % relative to control, subsequent to local administration of L-α-*cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester to intact calottes of mice

	Mass	X-ray density
0.6 mg/animal/day	+37%	+58%
1.6 mg/animal/day	+23%	+30%

Mean value, n = 6

Claims:

1. Use of lysophosphatidylic acid derivatives of general formula (I)



(I)

wherein

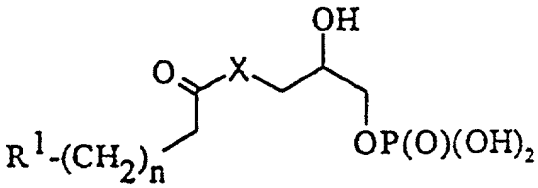
R^1 = alkyl, alkenyl or alkynyl having from 6 to 24 carbon atoms;

n = 0 - 12;

X = oxygen or NH;

and the physiologically tolerable salts, esters, optically active forms, racemates, and derivatives thereof which can be metabolized *in vivo* to yield compounds of general formula (I), in the production of drugs for treating bone metabolic disorders.

2. Compounds of formula (I)



(I)

wherein

R^1 = alkyl, alkenyl or alkynyl having from 6 to 24 carbon atoms;

n = 0 - 12;

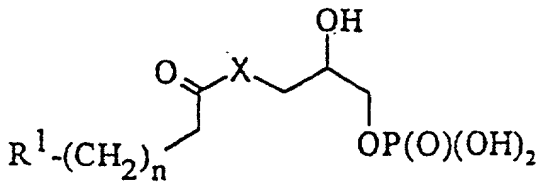
X = oxygen or NH;

the compounds (*all-cis*-5,8,11,14)-eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropyl ester, *cis*-9,*cis*-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester, (*all-cis*-9,12,15)-octadecatrienoic acid 2-hydroxy-3-phosphonooxypropyl ester, or *cis*-9-octadecenoic acid 2-hydroxy-3-phosphonooxypropyl ester being excluded, and with the proviso that if X represents oxygen, n in the $-(CH_2)_n-CH_3$ group does not represent the numbers 7, 9, 11, 13, or 15, and the physiologically tolerable salts, esters, optically active forms, racemates, and derivatives thereof which can be metabolized *in vivo* to yield compounds of general formula (I).

3. A drug, containing at least one compound of formula (I) according to claim 2, in addition to common carriers and adjuvants.

4. Use of compounds of formula (I) according to claim 2 in the production of drugs for treating bone metabolic disorders.

5. A drug, containing at least one compound of formula (I)



(I)

wherein

R^1 = alkyl, alkenyl or alkynyl having from 6 to 24 carbon atoms;

n = 0 - 12;

X = oxygen or NH;

the compounds (*all-cis*-5,8,11,14)-eicosatetraenoic acid 2-hydroxy-3-phosphonooxypropyl ester, *cis*-9,*cis*-12-octadecadienoic acid 2-hydroxy-3-phosphonooxypropyl ester, (*all-cis*-9,12,15)-octadecatrienoic acid 2-hydroxy-3-

phosphonooxypropyl ester, or *cis*-9-octadecenoic acid 2-hydroxy-3-phosphono-oxypropyl ester being excluded, and with the proviso that if X represents oxygen, n in the $-(CH_2)_n-CH_3$ group does not represent the numbers 9, 11, 13, or 15, and the physiologically tolerable salts, esters, optically active forms, racemates, and derivatives thereof which can be metabolized *in vivo* to yield compounds of general formula (I).

6. Use of compounds of formula (I) according to claim 3 in the production of drugs for treating bone metabolic disorders.

UNITED STATES PATENT AND TRADEMARK OFFICE

Combined Declaration For Patent And Power of Attorney (includes Reference to PCT international Applications)	ATTORNEY'S DOCKET NUMBER Case 20496

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Osteoblast-specific mitogens and drugs containing such compounds

the specification of which (check only one item below):

☐ is attached hereto

☐ was filed as United States application

Serial No. _____

on _____

and was amended

on _____ (if applicable).

☒ was filed as PCT international application

Number **PCT/EP98/06214**

on **September 30, 1998**

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations. §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN /PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day month year)	PRIORITY CLAIMED UNDER 35 USC 119
Europe	97117124.4	October 2, 1997	☒ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO

Combined Declaration For Patent Application and Power of Attorney (Continued)
(includes Reference to PCT international Applications)

ATTORNEY'S DOCKET NUMBER: Case 20496

I hereby claim the benefit under Title 35, United States Code. §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112. I acknowledge the duty to disclose material information as defined in Title 37. Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			
PCT/EP9806214	September 30, 1998				

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name and registra-ion number)*

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	POST OFFICE ADDRESS	POST OFFICE ADDRESS:	CITY:	STATE & ZIP CODE; COUNTRY:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE: March 23, 2000	DARE: March 23, 2000	DATE: